CHAPTER I

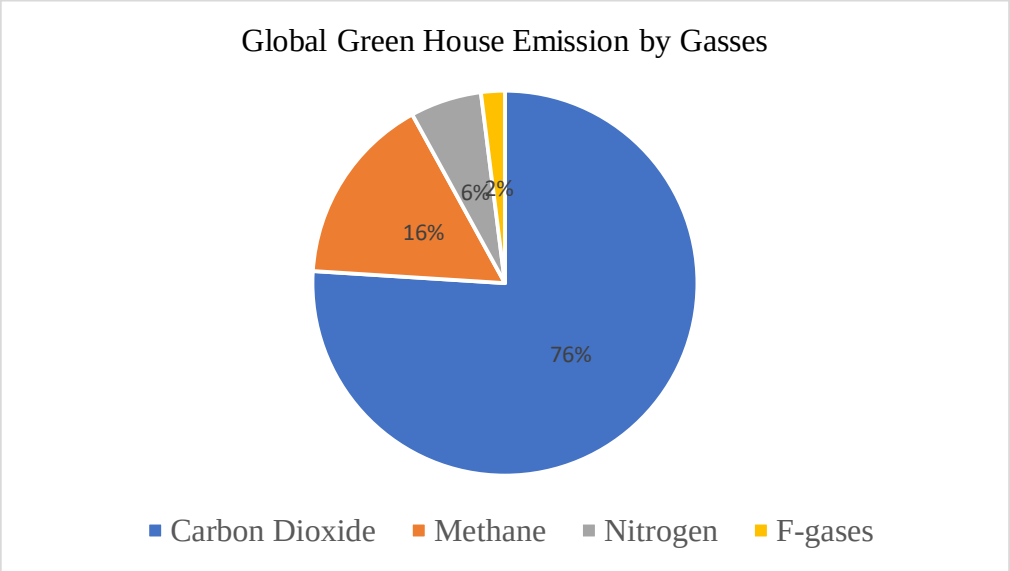
INTRODUCTION

1.1 Problem Identification

Climate change is a crucial issue facing our planet today. Climate change refers to significant long-term changes in climate, weather, and precipitation. (Ministry of Environment and Forestry of the Republic of Indonesia). According to the United Nations Framework Convention on Climate Change (UNFCCC), human activities have a direct or indirect impact on climate change, leading to temporary alterations in the atmosphere's composition and natural climate variability (Ministry of Environment and Forestry of the Republic of Indonesia)

Greenhouse gasses (GHG) are needed and essential to maintaining the stability of the earth’s temperature. However, the increasing concentrations of greenhouse gasses result in the thickening of the atmosphere. As the atmosphere thickens, more geothermal heat becomes trapped, leading to a rise in the Earth's temperature, commonly known as global warming. The greenhouse gasses found in the atmosphere include carbon dioxide, nitrogen, methane, and others (Ministry of Environment and Forestry of the Republic of Indonesia)

Diagram 1.1 percentage Composition of Global Greenhouse Gas Emissions

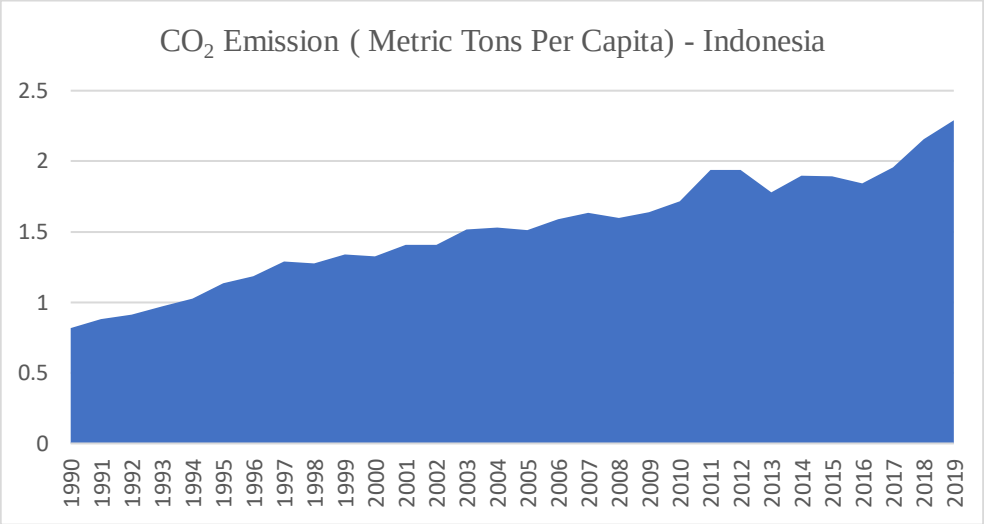


Sources: Intergovernmental Panel Climate Change (2014),

Environmental Protection Agency (2022)

Diagram 1.1 depicts the percentage composition of global greenhouse gasses processed using global greenhouse gas data in 2010. Based on the analysis of data shared by the Intergovernmental Panel on Climate Change (IPCC), the most significant greenhouse gas contributor is carbon dioxide gas at 76 percent, followed by methane gas at 16 percent, nitrogen at 6 percent, and fluorinated gasses at 2 percent. In addition, various countries have committed to reducing greenhouse gas emissions, particularly CO2, through the Paris Agreement (2015), the Kyoto Protocol (1997), and the presence of a G20 agreement on joint efforts to address the problem of climate change by the leaders of the G20 countries. The Paris Agreement resulted in an agreement among countries responsible for reducing CO2 emissions to suppress the increase in the earth's temperature by at least 2 degrees Celsius. Meanwhile, the Kyoto Protocol emphasizes and encourages industrialized countries to reduce greenhouse gas emissions from CO2.

Graph 1.1 CO_2 emission in Indonesia 1990-2019



Sources: WorldBank, World Development Indicators

The data in Graph 1.1 above shows the annual trend of CO2 emissions in Indonesia from 1990 to 2019. In the case of Indonesia, CO2 emission levels fluctuate but tend to increase every year. As shown in graph 1.1, the amount of CO2 emissions measured in metric tons per capita reached its highest level in the last three years (2017, 2018, and 2019) compared to previous years. This should be monitored and controlled because Indonesia participated in signing the Paris Agreement (2016), the Kyoto Protocol (1997), and the G20 countries summit (2022). In addition, as stated at the Conference of Parties (COP) 15 of 2009, Indonesia has set a target of reducing emissions by 29% using domestic resources and 41% with international assistance by 2030, to realize zero emissions by 2060 (President of the Republic of Indonesia, 2020).

Table 1.1 Indonesia's Share of Greenhouse Gas Emission (2019)

Sector	Share of Indonesia's Greenhouse Gas Emissions (Thousand Tonnes of CO_2)	percentage (%)
Energy	638.808	34
Industrial processes	60.175	3
Agriculture	108.598	6
Forestry & Land Use (AFOLU)	468.425	25
Forest Fires	456.427	24
Waste	134.119	7
Total	1.866.552	

Source: Greenhouse Gas Inventory and MPV Report (2020); Ministry of Environment and Forestry Republic of Indonesia; Central Bureau of Statistics (2022)

Furthermore, Table 1.1 indicates the sectors in Indonesia that contribute greenhouse gas emissions using units of measurement of thousands of tons of CO_2. The data in Table 1.1 is derived from data on Indonesia's greenhouse gas emissions in 2019. The energy sector is the most significant contributor to greenhouse gas emissions in Indonesia, accounting for 638,808 thousand tons of CO_2, or 34 percent of the total emissions. Energy is one part of the resource that plays an essential role in promoting economic development through production, distribution, and consumption activities. Moreover, Stern (2016) revealed that energy use or consumption drives the economy's industrialization and accumulation of development capital, either complementing or substituting in the production of outputs in the economy.

Most countries around the world strive for economic growth that can improve people's well-being in general. However, economic growth can occasionally lead to trade-offs or negative externalities for the environment.This phenomenon has also been explained in Simon Kuznets's Environmental Kuznets Curve hypothesis. According to this hypothesis, economic development, as measured by GDP (gross domestic product), is accompanied by increasing environmental damage (Panaĭotov et al., 1993). This is often due to people's focus on improving their economic standards without fully considering the long-term sustainability impact. Once GDP reaches a certain level, the economy tends to shift to the service sector, which requires less resource extraction and emphasizes increased environmental awareness in the community to minimize harmful environmental effects (Stern, 2018).

Financial development plays a critical role in triggering economic growth (Khan et al., 2021). The financial system, as an essential part of the economic system, allocates capital from surplus to deficit units. An unstable and inefficient financial system can lead to inefficient capital allocation, which hinders economic growth (Financial Services Authority). However, previous studies have shown that financial development, through providing loans to companies for adopting environmentally friendly technologies and implementing well-organized financial policies, can be a solution to improve environmental quality and reduce CO2 emissions (Binti Che Sab & Al-mulali, 2012; Shahbaz et al., 2018; Shahbaz et al., 2013).

In recent decades, several researchers have studied the relationship between financial development, economic growth, and CO2 emissions. However, the results of these studies have varied depending on the country. For example, Shahbaz et al. (2013) in Indonesia, Ali et al. (2018) in Nigeria, Shahbaz et al. (2018) in France, Khan et al. (2021) in 184 countries, Salahuddin et al. (2018) in Kuwait, and Hashmi and Alcam (2019) in OECD countries have shown that economic growth has a significant positive relationship with CO2 emissions. On the other hand, the research of Ozturk and Acaravci (2010) in Turkey yielded different results, indicating that the variable of economic growth does not affect CO2 emissions

In terms of the relationship between CO2 emissions and financial developments, Shahzad et al. (2017) in Pakistan and Ali et al. (2018) in Nigeria revealed that financial development has a significant effect on increasing CO2 emissions. In other kinds of literature, it gives contrasting results; even financial development was explained to help reduce CO2 emissions by discovering environmentally friendly technological innovations and providing capital for the construction of environmental facilities. These results were found in the studies conducted by researchers, including Shahbaz et al. (2013) in Malaysia, Shahbaz et al. (2013) in Indonesia, Shahbaz et al. (2018) in France, Feridun and Jalil (2011) in China, and Khan et al. (2021) in 184 countries. These different findings serve as the basis for the researcher's investigation of the relationship between financial development, economic growth, and CO2 emissions.

According to Shahbaz et al. (2013) in Indonesia, trade openness variables, in addition to financial development, are a solution for reducing CO2 emissions in the economic sector. This occurs because the existence of import activities enables

Indonesia to adopt more environmentally friendly technologies from developed countries. Therefore, based on this, the trade openness variable was included in this study.

This study focuses on Indonesia as the object of research. Indonesia is one of the countries that contributes the most emissions and pollution globally, ranking fifth in terms of carbon emissions between 1980 and 2021 (British Petroleum, 2021; Carbon Brief, 2022). Indonesia has also demonstrated its commitment to reducing emissions and pollution through agreements like the Paris Agreement (2016), the Kyoto Protocol (1997), and the agreement of the G20 member countries. This study is essential for Indonesia to evaluate the effect of reducing CO2 emissions, especially concerning financial development, economic growth, trade openness, and energy consumption.

From a geographical standpoint, Indonesia is an archipelagic country with over 17,000 islands, making it vulnerable to climate change risks (United Nations Environment Programme; Ministry of Finance, 2021). With 65 percent of the population living in coastal areas, rising sea levels pose a significant threat. Climate change also jeopardizes coral reefs, mangroves, seaweed, marine ecosystems, and biodiversity, as well as increases the risk of hydrometeorological disasters, which account for 80% of various disasters in Indonesia (Bappenas, 2021; Ministry of Finance, 2021). According to BMKG data, from 1981 to 2018, Indonesia's temperature has increased by about 0.03°C per year on average, leading to potential economic losses reaching 0.66% to 3.45% of GDP in 2030 (BMKG, 2020; Ministry of Finance, 2021).

This study is based on the work of Ali et al. (2018), who conducted similar research in Nigeria. The difference lies in the research object, and as explained above, the title of this study is **"The Effects of Economic Growth, Financial Development, Trade Openness, and Energy Consumption on CO2 Emissions in Indonesia."**

1.2 Formulation of The Problem

1. What is the effect of economic growth, financial development,trade openness and energy consumption on CO2 emissions in Indonesia?
2. What are the policy formulations that need to be carried out by Indonesia based on the results of this study?

1.3 Research Purposes

Referring to the stated problem formulation, the objectives of this study are:

1. To find out, test, and analyze the effects of economic growth,financial development, trade openness and energy consumption on CO2 emission in Indonesia
2. To provide policy advice to Indonesia regarding efforts to reduce CO2 emissions based on research variables.

1.4 Benefit of Research

The benefits of this research are expected to be able to contribute to the parties considered interested, as follows:

1. Benefits for science and technology, this study results are supposed to stipulate a different point of view and enrich the knowledge.
2. Benefits for researchers are expected to provide insight into the economic and environmental fields.

3. Benefits for academics, it is hoped that this research can be a reference for future researchers.
4. The research results are expected to provide recommendations for formulating policies related to CO_2 emissions through the sectors of economic growth, financial development, trade openness and energy consumption in Indonesia.